

## **APPENDIX B**

### **COST ESTIMATE BACKUP AND REPORT**

#### **NOTE:**

Appendix B contains a summary of the Cost Estimate. The complete cost estimate and all the backup data are available under separate cover. The backup data includes levee cross-section data in AUTOCAD format. The cross-sections are available on CD. To obtain the complete cost estimate and all the backup data, contact CALFED's Project Manager for the Levee System Integrity Program.



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## CALFED LEVEE REHABILITATION STUDY

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### INTRODUCTION

CALFED has chosen the levee standards established for the Delta under Public Law 84-99 (PL-99) as the minimum level of protection for system integrity. This study inventories the levees within the legal Delta not meeting the PL-99 standard and estimates quantities and costs required to rehabilitate these levees.

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### SCOPE OF STUDY

The study includes three main components: *an inventory of the levees not meeting the PL-99 standard, quantity and cost estimates to meet the standard, and an evaluation and estimated cost for the associated land, easements, rights of way, relocations and disposal (LERRD's) required to perform the levee rehabilitation.*

Generally, the levees not meeting the PL-99 standard consist of the non-project levees in the Delta (Figure 1). Unless there was specific knowledge of site conditions, project levees were assumed to meet the PL-99 standard. The inventory attempts to identify a complete listing of levee districts and associated levee miles not meeting the standard. In addition, the inventory identifies levees which meet the geometric standard but experience significant seepage during high water.

Quantity and cost estimates were based on a comparison of the design levee standard geometry as set forth in PL-99, to the existing levee configuration. Data used for these levee rehabilitation cost estimates included actual levee data from 60% of the existing non-project levee districts, representing 69% of the total mileage of substandard levees. The results of the estimates using actual data were then used to extrapolate the same information for islands where actual data was not available (Figure 2).

Finally, the study evaluated an estimated cost for the LERRD's associated with the levee rehabilitation. Generally, the required levee improvements extend from the levee toe landward into existing private property. In addition, the levee improvements impact existing

infrastructure which must be evaluated and costs estimated for work to move or replace the infrastructure. Components of this infrastructure include pumps and siphons, utility lines and poles, seepage and irrigation ditches and buildings. The LERRD's also include easement acquisition for the additional levee section. The results of this study are summarized on Table 1.

## **STUDY DETAILS**

The study estimates the quantity and cost required to obtain the PL-99 standards for 55 islands or levee districts totaling 521.2 miles of levee. Improvement costs, based on fill and roadway estimates, were used to project other costs associated with levee projects such as engineering, environmental and regulatory. Described below are details regarding the components of the cost estimates.

### **Fill Quantity Estimates**

The basis for establishing fill quantity required to meet the PL-99 standards is establishment of the standard levee section for a particular levee in the Delta. PL-99 simplifies its standard by requiring freeboard of 1.5' above the 100-year flood elevation, a 16' wide crown, a 2 (horizontal)-to-1 (vertical) waterside slope and a variable landside slope based on the levee height and estimated depth of organic material in the foundation. This varying landside slope ranges between 3:1 to 5:1 (Figure 3). Organic material depths were taken from the Department of Water Resources' map entitled, "Organic Isopach Map", October 18, 1976. Flood elevations were from the Corps of Engineers' report entitled, "Sacramento/San Joaquin Delta California Special Study Documentation Report", dated March 1993. Levee heights were computed from actual levee survey data.

Fifty-five of the Delta islands were found to not meet the PL-99 standards. Actual survey data from 32 of these islands was used for the cost estimates. These 32 islands represent 352 miles or 68% of the 521.2 miles of levee providing less than PL-99 level of protection. These survey data were obtained directly from the districts. At a minimum, cross sections were taken at 1,000' intervals. Using this data and superimposing the required PL-99 standard yields the "neat" fill requirements at each section. The average end method was then used to estimate the fill along the levee between each cross section.

The "neat" fill estimates were the basis for the Delta levee rehabilitation. The "neat" fill estimates were increased by 100% to account for losses associated with this type of work.

Losses amounting to 150% of the "neat" fill requirement were applied where the levee still appears to be experiencing significant foundation consolidation. Islands where this is occurring include Sherman, Twitchell, Empire, Bouldin, Tyler and Webb Tract. Much of the loss associated with levee rehabilitation on Delta islands is attributable to consolidation of organic material, consolidation of loosely compacted fill and accuracy of this survey data. Estimated fill based on the above factors is shown on Table 1.

The rehabilitated levee section will require replacement of existing access ramps. These ramps require approximately 1,000 cubic yards (cy) of fill material. Where the number of ramps was known, the corresponding additional fill material was added to the cross-section quantity estimates. Where the number of ramps was not known, an average of three ramps per levee mile was used to estimate the fill requirement needed for replacement of access ramps.

Detailed survey cross-sections were not obtained for 23 levee districts. The fill requirements to meet the PL-99 standard were extrapolated based on values estimated using detailed information. Five categories of fill requirement ranging from 5,000 cy to 100,000 cy per mile were used. Based on knowledge of the 23 districts, each was assigned the category which most nearly represented its need for levee material.

### **Roadway Quantity Estimates**

When raising and widening a levee, the gravel roadway is destroyed. Therefore, quantity estimates were made to replace the roadway under the CALFED system integrity program. Gravel was assumed to be 6-inches by 16-feet for the general levee section. For levees which currently support a county road, the roadway was designed as 6-inches by 24-feet of gravel subgrade covered by a 20 foot wide triple chip seal.

### **Cost Estimates**

Based on fill and roadway quantity estimates, cost estimates were calculated using high and low unit prices from actual Delta levee projects. Delta levee work experiences a great variance in cost due to factors such as proximity to borrow material, accessibility of the project, condition of access roads and workload of local contractors. It is anticipated that a program as extensive as the CALFED will generate new markets which don't currently exist,

thus keeping the levee costs to a minimum. For the sake of this study, the improvement costs were left to range between low and high.

### **Additional Costs**

Levee improvement includes an array of costs to account for services required to plan and construct a project. Based as a percentage of the subtotal of the fill and roadway cost estimates, the following costs were included:

- Engineering Planning and Design: \$10,000 + 5% to \$10,000 + 8%
- Geotechnical Analysis: 5% to 8%
- Construction Inspection and Contract Administration: 5% to 8%
- Environmental and Regulatory: 5% to 8%
- CMARP: 1%
- Erosion Protection for Newly Placed Fill: 8%
- Environmental Mitigation: 15%
- Ongoing Repair: 25%
- Overall Contingency to Account for Unforeseen Costs: 20%

### **Seepage Repair**

Although most federally reconstructed project levees in the Delta meet or exceed the PL-99 geometric standard, there are several locations where the sand composition of the levees causes a threat of seepage and piping of material during high water. This seepage could lead to a reduction in the factor of safety, diminishing the level of protection. The bulk of these levees are located along the San Joaquin River Channel upstream of Stockton. Several areas have also been noted along the Sacramento River and Georgian Slough. The total mileage where this type of repair is required was estimated based on accounts during the January 1997 floods. Cost estimates to repair this type of problem were based on costs estimated by the Corps of Engineers to repair levees along the San Joaquin River at Reclamation District No. 17 (Figure 4). It was assumed 33% of a district's levee system, where seepage has been a problem, would have to be repaired. Table 2 summarizes seepage repair estimates.

### **Lands, Easements, Rights of Way, Relocations and Disposal (LERRD'S)**

The third component of the study was to evaluate the cost of LERRD's resulting from the CALFED System Integrity Program. As described above, a rehabilitation as extensive as CALFED's program will impact existing infrastructure. Widening of the levees will encroach upon existing private property (Figure 5). Therefore, cost estimates were made to acquire easements for the existing land required due to the levee rehabilitation, and to move or replace existing infrastructure. This infrastructure includes irrigation and drainage pipes and pumping plants, power poles, homes and ditches. These estimates were based on recent experience of a similar type project performed on the levees surrounding the Stockton Metropolitan Area (Table 3).

### Summary

Based on the above, the total costs of the levee rehabilitation program is estimated to range from \$613 million to \$1.28 billion. The range is based on the uncertainty regarding location and cost of levee fill material. The breakdown for the costs, as shown on Tables 1-3, is as follows:

	Low	High
PL-99 Improvement Cost	\$ 356,970,324	\$ 1,023,686,285
Seepage Repair	\$ 164,229,790	\$ 164,229,790
LERRD's	\$ 92,028,000	\$ 92,028,000
	<u>\$ 613,228,114</u>	<u>\$ 1,279,944,075</u>

These costs include acquisition of easements over 3,419 acres for the PL-99 improvement and 1,209 acres for the seepage repair.

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## **CALFED Levee Rehabilitation Study: Borrow Material**

### **Introduction**

The CALFED Levee Rehabilitation Study has not taken a detailed look into the borrow material sources to meet demand required to complete the levee program improvements. However, the cost range used (\$7 to \$20 per cubic yard) in development of the cost estimates was chosen to cover the range of borrow source which could be used. The prices reflect material available very near the levee work (on-island) or imported from a distant commercial source. Future studies should determine which source would best accommodate the required levee improvements on each island and better define the cost estimate.

As the Study describes, required borrow material could approach 25 million cubic yards. This quantity is equal to 15,500 acre-feet, or fill from a 1-foot deep cut over 15,500 acres in area. In addition, the Levee Program will require an undetermined amount of fill for subsidence and habitat restoration. Described below are the various sources for borrow material required to complete the levee improvements.

### **On-Island Borrow**

On-island borrow is the least expensive and most convenient source of material. It also creates the opportunity for development of wetlands following excavation of levee material.

For estimating purposes, the Study used \$7 per cubic yard of on-island borrow. In actuality, large on-island borrow projects have been as low as \$4 per cubic yard. Although the Delta is known for its peat soils, there are many islands where enough mineral soil exists to complete the required improvements. These islands are generally outside the central Delta. The availability of this kind of material is limited to the islands that rim the Delta and islands located in southeastern Contra Costa County. A cursory review of the Delta indicates that at least 25 reclamation districts may have available material located within their boundaries. Mining permits can also be obtained which could allow export of material to neighboring borrow-deficient islands.

On-island borrow pits can be reclaimed for farming if the depth of cut is limited (generally 2-feet, or less). However, in order to keep the aerial extent of the borrow pit low, a deeper cut is the norm. During excavation it may be necessary to pull the water table down by use of pumps. Following completion of the project, the water table rebounds, creating a permanent wetland. Deep cutting is an extremely efficient use of land. A single acre cut to a depth of six feet can produce over 9,600 cubic yards of material.

## **Channel Dredging and Beneficial Reuse**

Historically, the Delta islands were reclaimed and maintained predominately by channel dredging. This method has diminished in use over the last 20 years due to increased regulatory constraints and lack of material replenishment. Generally, in the areas of the Delta influenced most by tides, channels have been dredged to their maximum extent. The rate of accretion in these areas is very low. In areas along the mainstem of Delta tributary rivers, accretion is still occurring, to the point that it is impacting flood control and navigation.

We have not made an estimate of available dredge material. However, the 1990 DWR Draft EIR/EIS for the North Delta Program estimated that 6.5 million cubic yards of material are available from dredging of the North and South Forks of the Mokelumne River for flood control purposes. Although similar studies have not been performed on the San Joaquin River, eyewitness accounts, and effects of the 1997 flood indicate that those channels will require dredging for flood control purposes.

Beneficial reuse of dredge material is the term used when discussing levee improvements using dredge material acquired from maintenance dredging of navigation channels, or ports. Use of this material on Delta levees has the potential of being a great benefit to navigation and levee maintenance. Currently, regulatory uncertainty and available less expensive means of disposal have held the use of this method to a minimum. However, based on the time frame that CALFED envisions for implementation of the levee program, this method should become much more feasible in the future.

## **Import Fill**

Import fill refers to acquisition and transportation of fill material from sources outside the boundaries of a reclamation district. This method is generally the highest cost of fill material, but there is an ample supply of these sources in and around the Delta.

A recent study performed for the San Joaquin Area Flood Control Agency found that there are over 30 commercial sources of material within a 30-mile radius of Stockton. A similar study around the remainder of the Delta would surely produce many additional sources.

The upper end of the fill material cost range (\$20 per cubic yard) accounted for import fill. Therefore, even though it is costly and would be utilized as a last resort, its use has been taken into account. It also appears there is plenty of import material available. In addition, the demand generated by the CALFED levee program will tend to drive down the current price of this material.



## **New Markets and Available Opportunities**

The magnitude of funding required to produce the levee improvements envisioned in the CALFED Levee Program will generate new markets in the area of available material. Not only will there be private entities looking to benefit from mining of material, but public agencies and environmental interests will also take advantage of the opportunity. A recent flood control project involving the levees around the Stockton area utilized fill generated by excavation of ponds necessary to detain local flood waters. This type of opportunity will repeat itself in the future since the communities surrounding the Delta are experiencing rapid growth. As stated above, excavation of material also produces adequate ground levels for development of permanent wetlands.

## **Conclusion**

Although no definitive studies have been performed to pinpoint sources of material for the CALFED Levee Program, the material presented herein indicates that the material exists in, or near, the Delta. Moreover, the current cost estimate range includes, as its upper end, the possibility that import fill may be required to complete the levee improvements.

# Sacramento-San Joaquin Delta, California

## Levee Rehabilitation Study

District Number	Reclamation District	Levee Miles			Total Fill Volume (yd <sup>3</sup> )	Estimated PL-99 Improvement Cost	
		Project	Non-Project	Total		Low	High
556	1 Andrus Island, Upper	11.2	0.6	11.8	30,000	\$517,290	\$1,408,450
2126	1 Atlas Tract	0.0	1.9	1.9	57,000	\$927,394	\$2,631,111
2028	1 Bacon Island	0.0	14.3	14.3	1,420,443	\$20,712,541	\$60,697,769
	2 Bear Creek	46.5	0.0	46.5	0	\$0	\$0
	2 Bethany			0.0	0	\$0	\$0
	Bethel Island MID	0.0	11.5	11.5	230,634	\$4,188,633	\$11,473,059
2042	2 Bishop Tract	0.0	5.8	5.8	0	\$0	\$0
	2 Bishop Tract, East			0.0	0	\$0	\$0
2121	2 Bixler	0.0	2.3	2.3	0	\$0	\$0
404	2 Boggs (Moss) Tract	4.0	1.2	5.2	0	\$0	\$0
	2 Borrow Pond Area			0.0	0	\$0	\$0
756	Bouldin Island	0.0	18.0	18.0	2,454,122	\$33,917,002	\$101,465,550
2033	Brack Tract	0.0	10.8	10.8	246,291	\$4,162,288	\$11,645,933
2059	Bradford Island	0.0	7.4	7.4	797,028	\$11,222,624	\$33,430,057
317, 407 & 2067	Brannan-Andrus LMD	19.3	10.1	29.4	1,260,711	\$19,147,841	\$54,942,188
	2 Browns Island			0.0	0	\$0	\$0
800	2 Byron Tract	0.0	9.7	9.7	0	\$0	\$0
2098	2 Cache Haas	12.1	0.0	12.1	0	\$0	\$0
2086	Canal Ranch	0.0	7.5	7.5	511,350	\$7,374,253	\$21,731,317
	2 Chippis Island			0.0	0	\$0	\$0
	2 Clifton Court			0.0	0	\$0	\$0
	2 Collinsville			0.0	0	\$0	\$0
2117	Coney Island	0.0	5.4	5.4	37,477	\$1,004,522	\$2,428,368
2111	1 Dead Horse Island	0.0	2.6	2.6	13,258	\$384,338	\$915,177
	2 Decker			0.0	0	\$0	\$0
	2 Delta-Mendota			0.0	0	\$0	\$0
	1 Drexler Island	0.0	4.0	4.0	20,000	\$614,178	\$1,495,435
536	2 Egbert Tract	14.0	0.0	14.0	0	\$0	\$0
813	2 Ehrheart	2.0	6.0	8.0	0	\$0	\$0
2029	Empire Tract	0.0	10.5	10.5	1,093,053	\$15,737,352	\$46,227,173
773	1 Fabian Tract	0.0	18.8	18.8	188,000	\$4,541,103	\$11,439,905
2113	1 Fay Island	0.0	1.6	1.6	8,026	\$240,435	\$569,585
1002	1 Glanville Tract	0.0	13.0	13.0	65,099	\$2,335,317	\$5,292,676
765	2 Glide	1.7	4.0	5.7	0	\$0	\$0
3	2 Grand Island	29.0	0.0	29.0	0	\$0	\$0
1609	2 Harveys			0.0	0	\$0	\$0
2060	2 Hastings Tract	16.0	0.0	16.0	0	\$0	\$0
999	2 Holland Land	27.0	5.8	32.8	0	\$0	\$0
2025	Holland Tract	0.0	10.9	10.9	182,612	\$3,816,975	\$9,912,258
2116	2 Holt Station	0.0	0.4	0.4	0	\$0	\$0
799	1 Hotchkiss Tract	0.0	6.3	6.3	121,248	\$2,371,992	\$6,406,959
830	1 Jersey Island	0.0	15.6	15.6	468,000	\$7,527,319	\$21,485,215
2038	Jones Tract, Lower	0.0	8.8	8.8	173,847	\$3,283,897	\$8,908,588
2039	Jones Tract, Upper	0.0	9.3	9.3	32,586	\$866,491	\$2,142,417
2085	2 Kasson	6.2		6.2	0	\$0	\$0
	2 Kimball Island			0.0	0	\$0	\$0
2044	King Island	0.0	9.0	9.0	276,103	\$4,483,102	\$12,688,246
369	1 Libby McNeil	1.0	0.7	1.7	66,000	\$981,195	\$2,864,665
2093	2 Liberty Island	0.0	20.5	20.5	0	\$0	\$0
1608	2 Lincoln Village West	0.0	4.0	4.0	0	\$0	\$0
307	2 Lisbon	7.8	5.2	13.0	0	\$0	\$0
2084	2 Little Egbert Tract	0.0	7.0	7.0	0	\$0	\$0
	2 Little Franks Tract			0.0	0	\$0	\$0
2118	1 Little Mandeville	0.0	4.5	4.5	450,000	\$6,348,833	\$18,876,664
	2 Los Medanos			0.0	0	\$0	\$0
	2 Maintenance Area 9	19.6	0.0	19.6	0	\$0	\$0
2027	Mandeville Island	0.0	14.3	14.3	502,358	\$7,789,541	\$22,407,366
2110	1 McCormack-Williamson Tract	0.0	8.8	8.8	525,000	\$7,696,924	\$22,600,613
2030	McDonald Island	0.0	13.7	13.7	98,170	\$2,482,325	\$6,316,103
2075	2 McMullin	7.4	0.0	7.4	0	\$0	\$0
2041	Medford Island	0.0	5.9	5.9	453,667	\$6,494,287	\$19,197,006
150	2 Merritt Island	18.1	0.0	18.1	0	\$0	\$0
2021	2 Mildred Island	0.0	7.3	7.3	0	\$0	\$0
	2 Montezuma Flats			0.0	0	\$0	\$0
	2 Montezuma Island			0.0	0	\$0	\$0
2107	2 Mossdale 2	4.2	0.0	4.2	0	\$0	\$0
17	2 Mossdale Tract	14.0	0.0	14.0	0	\$0	\$0
1007	1 Naglee Burke Tract	0.0	8.3	8.3	83,000	\$1,813,377	\$4,762,587
348	New Hope Tract	0.0	18.6	18.6	291,322	\$4,928,678	\$13,860,672

# Sacramento-San Joaquin Delta, California

## Levee Rehabilitation Study

District Number	Reclamation District	Levee Miles			Total Fill Volume (yd <sup>3</sup> )	Estimated PL-99 Improvement Cost	
		Project	Non-Project	Total		Low	High
	2 Oakley			0.0	0	\$0	\$0
2024	Orwood Tract	0.0	10.9	10.9	12,633	\$729,834	\$1,640,042
2036	Palm Tract	0.0	7.5	7.5	199,301	\$3,298,313	\$9,338,080
2095	2 Paradise	4.0	0.0	4.0	0	\$0	\$0
2058	1 Pescadero Tract	6.7	2.2	8.9	43,340	\$1,325,842	\$3,248,954
2104	2 Peters	7.4	0.0	7.4	0	\$0	\$0
551	2 Pierson District	8.4	7.0	15.4	0	\$0	\$0
1667	2 Prospect Island	2.9	7.1	10.0	0	\$0	\$0
2090	Quimby Island	0.0	7.0	7.0	426,462	\$6,244,751	\$18,343,567
755	2 Randall	1.9	0.0	1.9	0	\$0	\$0
2037	Rindge Tract	0.0	15.7	15.7	520,276	\$8,310,102	\$23,847,863
2114	2 Rio Blanco Tract	0.0	4.0	4.0	0	\$0	\$0
2064	2 River Junction	11.6	0.0	11.6	0	\$0	\$0
524	1 Robert Island, Middle	6.1	3.7	9.8	63,447	\$1,932,828	\$4,741,046
684	Roberts Island, Lower	0.0	16.0	16.0	43,689	\$1,824,462	\$4,259,136
544	1 Roberts Island, Upper	10.6	4.4	15.0	88,068	\$2,678,112	\$6,574,274
	2 Rough and Ready Island	0.0	6.7	6.7	0	\$0	\$0
501	2 Ryer Island	20.6	0.0	20.6	0	\$0	\$0
	2 Sacramento Deepwater			0.0	0	\$0	\$0
2074	2 Sargent Barnhart Tract	1.5	2.8	4.3	0	\$0	\$0
341	Sherman Island	9.7	9.8	19.5	321,559	\$5,778,494	\$15,639,373
	2 Sherman Island, West			0.0	0	\$0	\$0
2115	Shima Tract	0.0	6.6	6.6	41,563	\$1,142,313	\$2,853,331
	1 Shin Kee Tract	0.0	3.9	3.9	360,000	\$5,079,744	\$15,099,311
	2 SJCFCD Five Mile Slough			0.0	0	\$0	\$0
	2 SJCFCD Fourteen Mile Slough			0.0	0	\$0	\$0
	2 SJCFCD Mosher Slough			0.0	0	\$0	\$0
1614	2 Smith Tract	6.0	2.8	8.8	0	\$0	\$0
	2 Spinner Island			0.0	0	\$0	\$0
2089	2 Stark	2.9	0.7	3.6	0	\$0	\$0
38	Staten Island	0.0	25.4	25.4	921,949	\$14,349,298	\$41,373,293
2062	2 Stewart Tract	12.3	0.0	12.3	0	\$0	\$0
349	2 Sutter Island	12.5	0.0	12.5	0	\$0	\$0
548	1 Terminous Tract	0.0	16.1	16.1	1,262,330	\$18,495,932	\$54,337,453
2108	2 Tinsley			0.0	0	\$0	\$0
1601	Twitchell Island	2.5	9.3	11.8	1,291,084	\$18,588,176	\$54,670,526
563	Tyler Island	12.2	10.7	22.9	2,863,563	\$41,800,546	\$121,994,769
1	Union Island, East	1.0	13.0	14.0	0	\$0	\$0
2	1 Union Island, West	0.0	16.2	16.2	80,492	\$2,611,017	\$6,240,156
1607	1 Van Sickle Island	0.0	3.8	3.8	380,000	\$5,357,353	\$15,925,323
2065	Veale Tract	0.0	5.7	5.7	21,243	\$718,854	\$1,721,402
2023	1 Venice Island	0.0	12.3	12.3	123,977	\$2,668,367	\$7,001,564
2040	1 Victoria Island	0.0	15.1	15.1	150,775	\$3,316,281	\$8,735,545
554	2 Walnut Grove	1.0	1.2	2.2	0	\$0	\$0
2094	2 Walthall	3.3	0.0	3.3	0	\$0	\$0
2026	Webb Tract	0.0	12.8	12.8	606,166	\$9,042,328	\$26,322,968
828	2 Weber	0.0	1.2	1.2	0	\$0	\$0
	2 West Island			0.0	0	\$0	\$0
900	2 West Sacramento	12.0	1.3	13.3	0	\$0	\$0
2096	2 Wetherbee	0.2	0.0	0.2	0	\$0	\$0
2122	1 Winter Island	0.0	4.8	4.8	480,000	\$6,765,248	\$20,115,682
2072	Woodward Island	0.0	8.8	8.8	323,327	\$5,042,183	\$14,524,929
2119	Wright-Elmwood Tract	0.0	6.8	6.8	82,516	\$1,957,902	\$4,914,584
2068	2 Yolano	8.7	0.0	8.7	0	\$0	\$0
	2 Yolo Bypass Unit 4	3.6	0.0	3.6	0	\$0	\$0
		430.6	635.2	1065.8	22,864,165	\$356,970,324	\$1,023,686,285

1 Extrapolated Values

2 Project Levee, Meets or Exceeds PL84-99 or Non-Levee

Districts	Levee Miles	
	Project	Non-Project
Detailed Quantity Estimates	32	352.0
Extrapolated Values	23	169.2
Project Levee, Meets or Exceeds PL84-99 or Non-Levee	69	114.0
	124	635.2

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# Sacramento - San Joaquin Delta, California

## Levee Rehabilitation Study

### Seepage Control

Reclamation District No.	Name of Island/Tract	Mobilization/Demo (cost est.)	Berm Drain Rock (cost est.)	Berm Material (cost est.)	Geotextile (cost est.)	Total (cost est.)
317, 407 & 2067	Brannan-Andrus Island	\$150,000	\$21,318,528	\$2,173,248	\$3,622,080	\$27,263,856
3	Grand Island	\$150,000	\$21,028,480	\$2,143,680	\$3,572,800	\$26,894,960
2025	Holland Tract	\$150,000	\$7,903,808	\$805,728	\$1,342,880	\$10,202,416
2075	McMullin Ranch	\$150,000	\$5,365,888	\$547,008	\$911,680	\$6,974,576
2107	Mossdale 2	\$150,000	\$3,045,504	\$310,464	\$517,440	\$4,023,408
17	Mossdale Tract	\$150,000	\$10,151,680	\$1,034,880	\$1,724,800	\$13,061,360
2095	Paradise	\$150,000	\$2,900,480	\$295,680	\$492,800	\$3,838,960
2058	Pescadero Tract	\$150,000	\$6,453,568	\$657,888	\$1,096,480	\$8,357,936
2064	River Junction	\$150,000	\$8,411,392	\$857,472	\$1,429,120	\$10,847,984
684	Roberts Island, Lower	\$150,000	\$11,601,920	\$1,182,720	\$1,971,200	\$14,905,840
524	Roberts Island, Middle	\$150,000	\$7,106,176	\$724,416	\$1,207,360	\$9,187,952
544	Roberts Island, Upper	\$150,000	\$10,876,800	\$1,108,800	\$1,848,000	\$13,983,600
2062	Stewart Tract	\$150,000	\$8,918,976	\$909,216	\$1,515,360	\$11,493,552
2094	Walthall	\$150,000	\$2,392,896	\$243,936	\$406,560	\$3,193,392
<b>SEEPAGE CONTROL GRAND TOTAL:</b>						<b>\$164,229,790</b>

**Sacramento - San Joaquin Delta, California**  
**Lands, Easements, Right of Ways, Relocations & Disposals**  
**(LERRDS)**

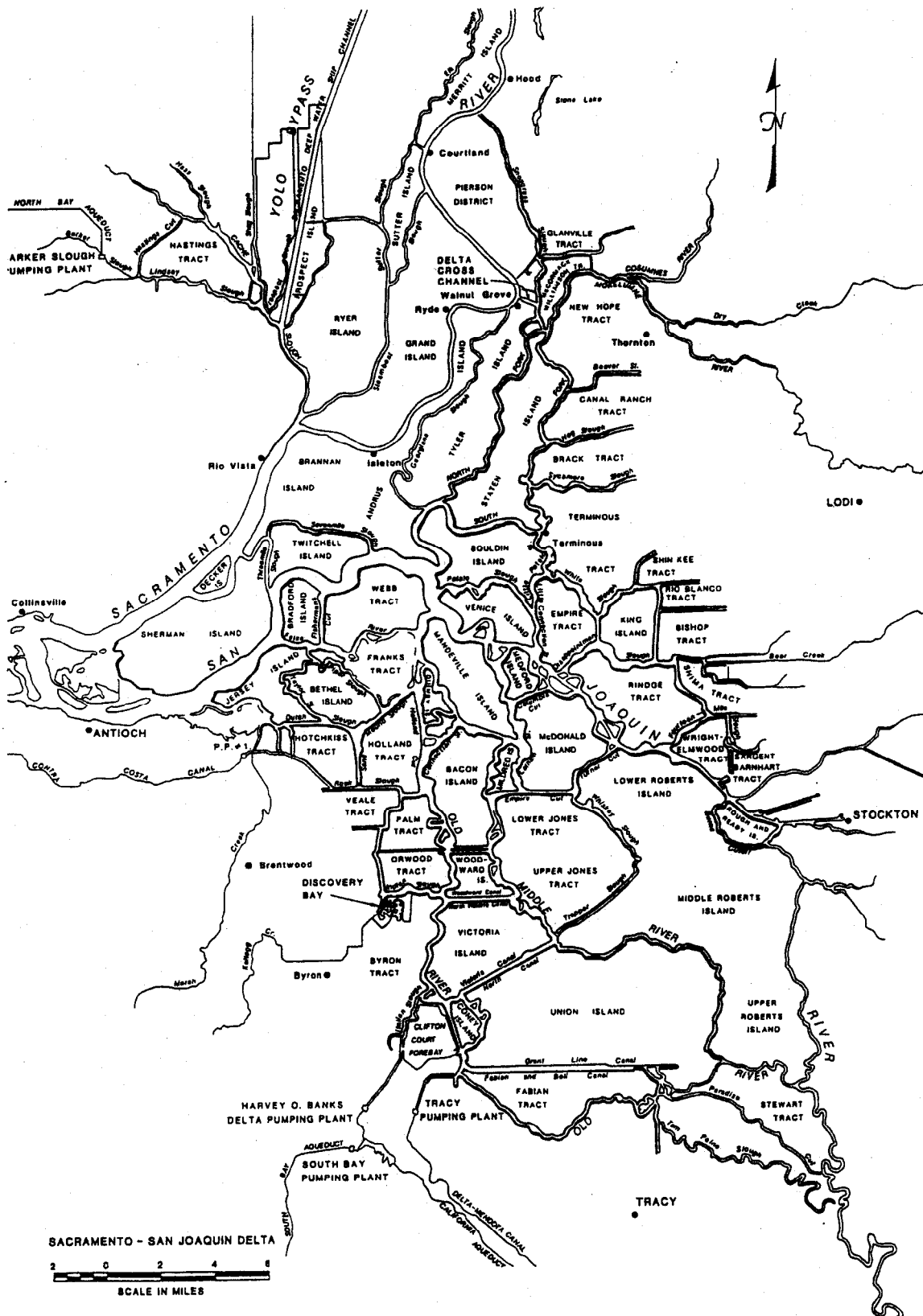
Reclamation District No.	Name of Island/Tract	Negotiation (cost est.)	Land (cost est.)	Toe Drain (cost est.)	Siphons (cost est.)	Power Poles (cost est.)	Land (seepage) (cost est.)	Total LERRDS (cost est.)
556	Andrus Island, Upper	\$15,000	\$8,000	\$5,000	\$15,000	\$100,000	\$0	\$143,000
2126	Atlas Tract	\$90,000	\$32,000	\$20,000	\$60,000	\$100,000	\$0	\$302,000
2028	Bacon Island	\$405,000	\$396,000	\$151,000	\$975,000	\$100,000	\$0	\$2,027,000
	Bethel Island MID	\$10,230,000	\$10,259,000	\$122,000	\$345,000	\$100,000	\$0	\$21,056,000
756	Bouldin Island	\$105,000	\$435,000	\$190,000	\$795,000	\$125,000	\$0	\$1,650,000
2033	Brack Tract	\$225,000	\$224,000	\$122,000	\$300,000	\$100,000	\$0	\$971,000
2059	Bradford Island	\$915,000	\$212,000	\$78,000	\$120,000	\$100,000	\$0	\$1,425,000
317, 407 & 2067	Brannan-Andrus LMD	\$3,330,000	\$219,000	\$136,000	\$390,000	\$100,000	\$136,000	\$4,175,000
2086	Canal Ranch	\$105,000	\$257,000	\$102,000	\$315,000	\$100,000	\$0	\$879,000
2117	Coney Island	\$30,000	\$92,000	\$57,000	\$75,000	\$100,000	\$0	\$354,000
2111	Dead Horse Island	\$60,000	\$51,000	\$28,000	\$105,000	\$100,000	\$0	\$344,000
	Drexler Island	\$90,000	\$68,000	\$42,000	\$120,000	\$100,000	\$0	\$420,000
2029	Empire Tract	\$255,000	\$275,000	\$111,000	\$705,000	\$100,000	\$0	\$1,446,000
773	Fabian Tract	\$435,000	\$319,000	\$199,000	\$570,000	\$130,000	\$0	\$1,653,000
2113	Fay Island	\$45,000	\$31,000	\$17,000	\$45,000	\$100,000	\$0	\$238,000
1002	Glanville Tract	\$255,000	\$253,000	\$137,000	\$30,000	\$100,000	\$0	\$775,000
3	Grand Island	\$2,175,000	\$0	\$0	\$870,000	\$100,000	\$1,406,000	\$3,145,000
2025	Holland Tract	\$435,000	\$223,000	\$116,000	\$360,000	\$100,000	\$103,000	\$1,234,000
799	Hotchkiss Tract	\$375,000	\$2,310,000	\$94,000	\$570,000	\$100,000	\$0	\$3,449,000
830	Jersey Island	\$315,000	\$265,000	\$165,000	\$465,000	\$105,000	\$0	\$1,315,000
2038	Jones Tract, Lower	\$180,000	\$162,000	\$95,000	\$330,000	\$100,000	\$0	\$867,000
2039	Jones Tract, Upper	\$120,000	\$85,000	\$53,000	\$255,000	\$100,000	\$0	\$613,000
2044	King Island	\$180,000	\$207,000	\$96,000	\$615,000	\$100,000	\$0	\$1,198,000
369	Libby McNeil	\$15,000	\$19,000	\$12,000	\$30,000	\$100,000	\$0	\$176,000
2118	Little Mandeville	\$15,000	\$76,000	\$48,000	\$90,000	\$100,000	\$0	\$329,000
2027	Mandeville Island	\$105,000	\$275,000	\$150,000	\$300,000	\$100,000	\$0	\$930,000
2110	McCormack-Williamson Tract	\$660,000	\$427,000	\$93,000	\$264,000	\$100,000	\$0	\$1,544,000
2030	McDonald Island	\$150,000	\$247,000	\$145,000	\$450,000	\$100,000	\$0	\$1,092,000
2075	McMullin Ranch	\$555,000	\$0	\$0	\$222,000	\$100,000	\$359,000	\$877,000
2041	Medford Island	\$60,000	\$120,000	\$62,000	\$150,000	\$100,000	\$0	\$492,000
2107	Mossdale 2	\$315,000	\$0	\$0	\$126,000	\$100,000	\$204,000	\$541,000
17	Mossdale Tract	\$1,050,000	\$0	\$0	\$420,000	\$100,000	\$679,000	\$1,570,000
1007	Naglee Burke	\$180,000	\$141,000	\$88,000	\$255,000	\$100,000	\$0	\$764,000
348	New Hope Tract	\$645,000	\$316,000	\$197,000	\$555,000	\$130,000	\$0	\$1,843,000
2024	Orwood Tract	\$225,000	\$108,000	\$67,000	\$195,000	\$100,000	\$0	\$695,000
2036	Palm Tract	\$30,000	\$134,000	\$83,000	\$240,000	\$100,000	\$0	\$587,000
2095	Paradise	\$300,000	\$0	\$0	\$120,000	\$100,000	\$194,000	\$520,000
2058	Pescadero Tract	\$180,000	\$147,000	\$92,000	\$150,000	\$100,000	\$91,000	\$669,000
2090	Quimby Island	\$30,000	\$135,000	\$74,000	\$90,000	\$100,000	\$0	\$429,000
2037	Rindge Tract	\$240,000	\$329,000	\$167,000	\$1,005,000	\$110,000	\$0	\$1,851,000
2064	River Junction	\$870,000	\$0	\$0	\$348,000	\$100,000	\$562,000	\$1,318,000
684	Roberts Island, Lower	\$780,000	\$251,000	\$156,000	\$795,000	\$100,000	\$155,000	\$2,082,000
524	Roberts Island, Middle	\$255,000	\$215,000	\$134,000	\$255,000	\$100,000	\$133,000	\$959,000
544	Roberts Island, Upper	\$360,000	\$299,000	\$186,000	\$360,000	\$120,000	\$185,000	\$1,325,000
341	Sherman Island	\$1,440,000	\$329,000	\$205,000	\$585,000	\$135,000	\$0	\$2,694,000
2115	Shima Tract	\$60,000	\$111,000	\$69,000	\$120,000	\$100,000	\$0	\$460,000
	Shin Kee Tract	\$15,000	\$61,000	\$38,000	\$105,000	\$100,000	\$0	\$319,000
38	Staten Island	\$15,000	\$554,000	\$268,000	\$765,000	\$180,000	\$0	\$1,782,000
2062	Stewart Tract	\$930,000	\$0	\$0	\$369,000	\$100,000	\$596,000	\$1,399,000
548	Terminus Tract	\$630,000	\$343,000	\$170,000	\$615,000	\$110,000	\$0	\$1,868,000
1601	Twitchell Island	\$345,000	\$254,000	\$126,000	\$345,000	\$100,000	\$0	\$1,170,000
563	Tyler Island	\$705,000	\$542,000	\$246,000	\$915,000	\$165,000	\$0	\$2,573,000
1	Union Island, East	\$300,000	\$255,000	\$159,000	\$300,000	\$100,000	\$0	\$1,114,000

**Sacramento - San Joaquin Delta, California**  
**Lands, Easements, Right of Ways, Relocations & Disposals**  
**(LERRDS)**

Reclamation District No.	Name of Island/Tract	Negotiation (cost est.)	Land (cost est.)	Toe Drain (cost est.)	Siphons (cost est.)	Power Poles (cost est.)	Land (seepage) (cost est.)	Total LERRDS (cost est.)
2	<sup>1</sup> Union Island, West	\$375,000	\$273,000	\$170,000	\$885,000	\$110,000	\$0	\$1,813,000
1607	Van Sickle Island	\$90,000	\$64,000	\$40,000	\$120,000	\$100,000	\$0	\$414,000
2065	Veale Tract	\$45,000	\$86,000	\$53,000	\$150,000	\$100,000	\$0	\$434,000
2023	<sup>1</sup> Venice Island	\$90,000	\$240,000	\$131,000	\$375,000	\$100,000	\$0	\$936,000
2040	<sup>1</sup> Victoria Island	\$120,000	\$292,000	\$159,000	\$495,000	\$100,000	\$0	\$1,166,000
2094	<sup>1</sup> Walthall	\$255,000	\$56,000	\$35,000	\$99,000	\$100,000	\$35,000	\$545,000
2026	Webb Tract	\$270,000	\$269,000	\$136,000	\$330,000	\$100,000	\$0	\$1,105,000
2122	<sup>1</sup> Winter Island	\$15,000	\$81,000	\$51,000	\$150,000	\$100,000	\$0	\$397,000
2072	Woodward Island	\$90,000	\$163,000	\$94,000	\$330,000	\$100,000	\$0	\$777,000
2119	Wright-Elmwood Tract	\$165,000	\$120,000	\$75,000	\$330,000	\$100,000	\$0	\$790,000
<b>LERRDS GRAND TOTAL:</b>								<b>\$92,028,000</b>

<sup>1</sup> Extrapolated: When no specific data was available, the data was derived from adjoining islands/tracts with similar conditions.

# CALFED Levee Rehabilitation Study

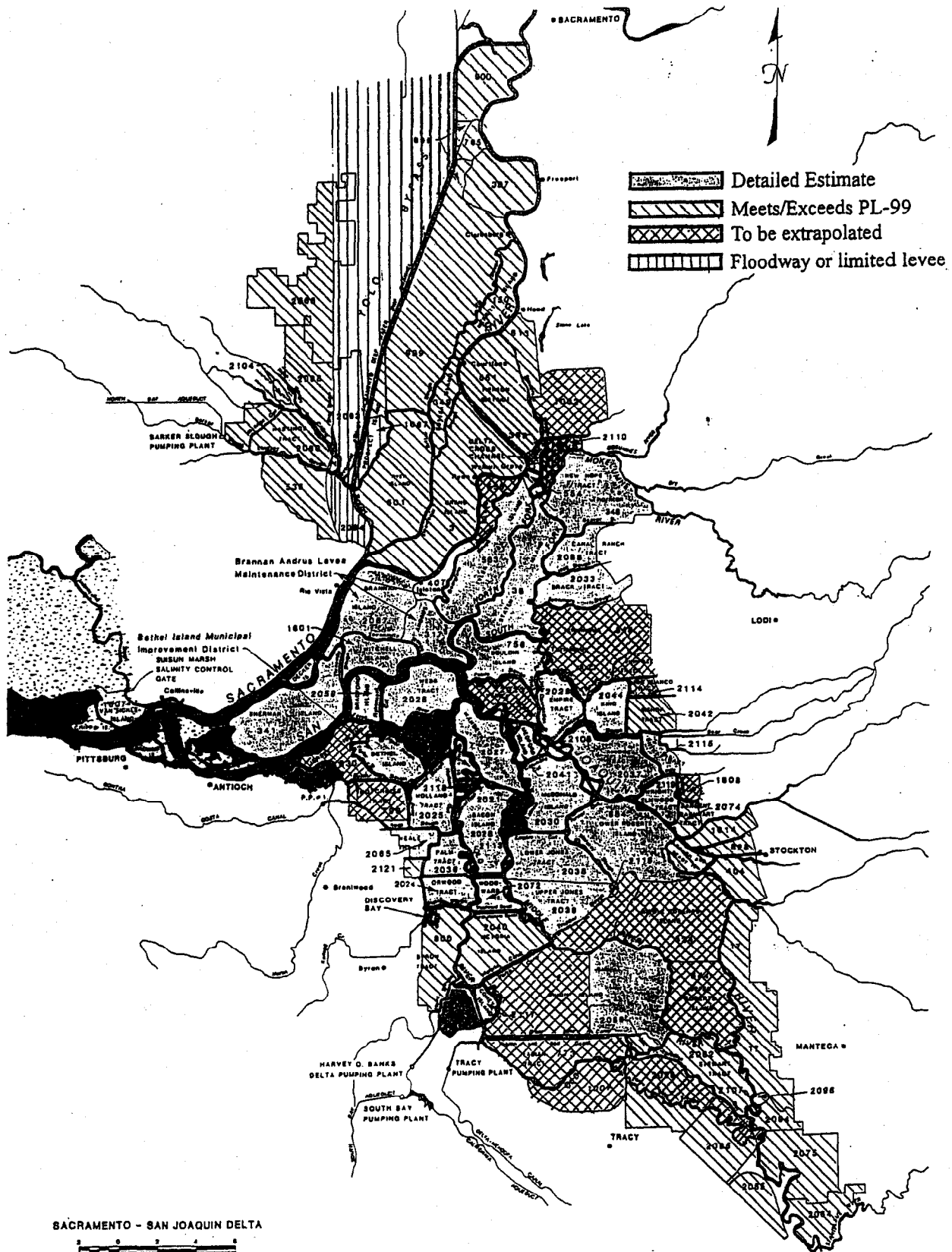


MURRAY BURNS AND KIENLEN - Consulting Civil Engineers  
1616 29th Street Ste 300, Sacramento CA 95816 - (916) 456-4400

Local Flood Control Nonproject Levees

Figure 1

# CALFED Levee Rehabilitation Study



MURRAY BURNS AND KIENLEN - Consulting Civil Engineers  
1616 29th Street Ste 300, Sacramento CA 95816 - (916) 456-4400

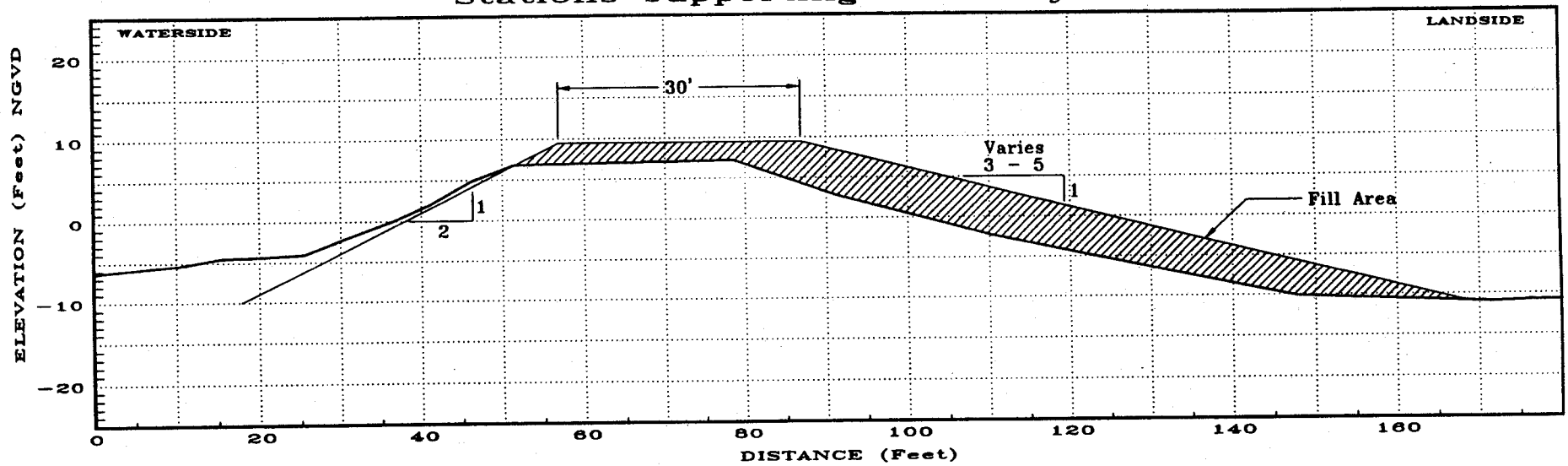
Reclamation and Levee Maintenance Districts

Figure 2



## TYPICAL LEVEE CROSS SECTION

Stations supporting a County Road



Stations not supporting a County Road

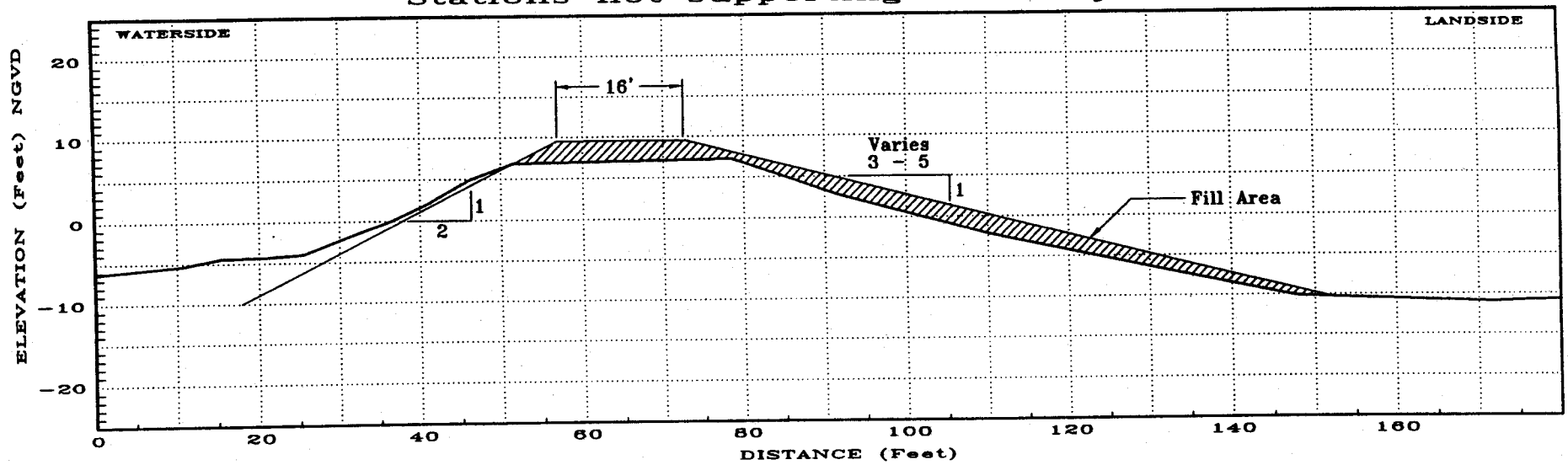


Figure 3

# Typical Seepage Gravel Berm Cross Section

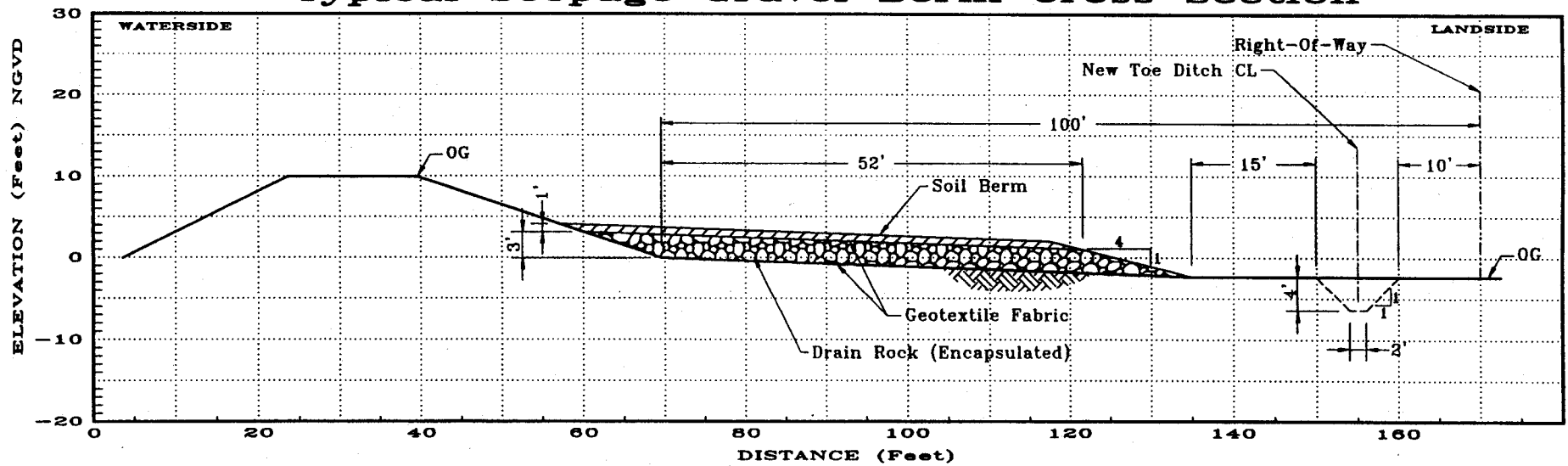


Figure 4

# Typical Right-Of-Way Cross Section

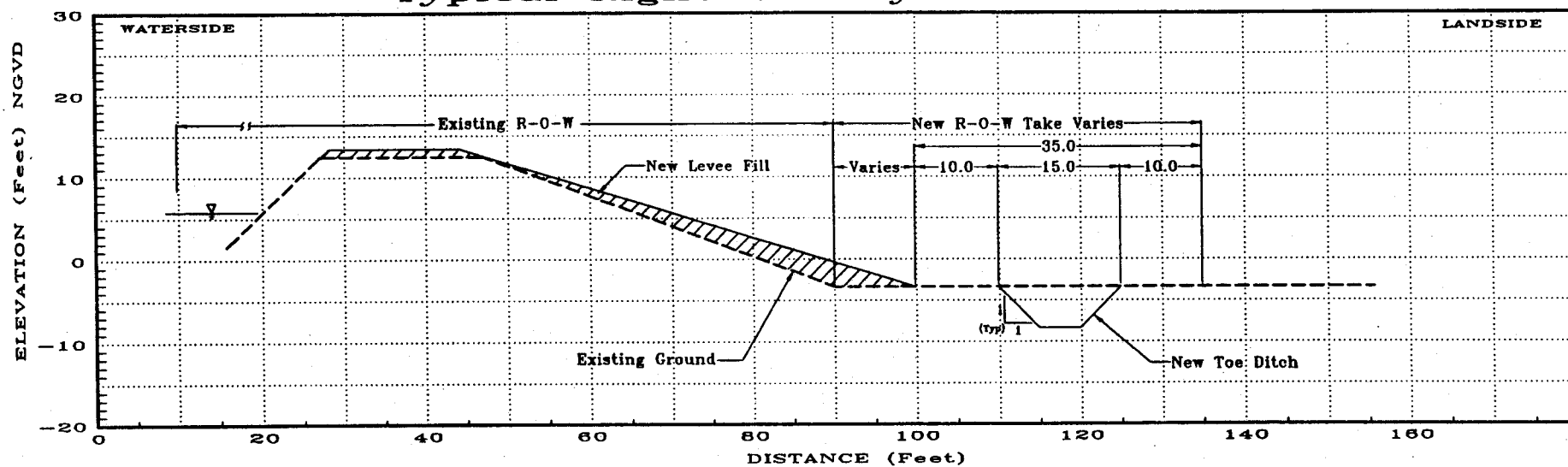


Figure 5